

standard,* or by adopting a system that allows initially for the simulcasting of NTSC and HDTV transmissions, which is analogous to the situation following the adoption of FM radio standards in 1940.**

Fifth, the advanced television system should be based on an efficient use of the radio frequency spectrum. This means that valuable frequencies should be used as effectively as possible to achieve the performance goals set forth above. While preference should be given to proposals that make use of the current frequency allocations without disrupting the current frequency plan, the desire to stay within the 6 MHz allocation should not take precedence over broadcasters' capacity to deliver a competitive product. In CBS's view, therefore, to be acceptable as the terrestrial HDTV emission standard a system must meet the other criteria -- with special emphasis on the performance criteria -- and use the minimum spectrum necessary to do so.

Sixth, the advanced television system should be designed so that the 1125/60 production system can be used as a program source. This approach would provide direct access to all current and future sources of HDTV programming.

* Report and Order, Docket No. 10637, 41 FCC 658, 671 (1953) ("Color Television Order").

** Report on Frequency Modulation, Docket No. 5805, 39 FCC 29 (1940).

B. The Status Of Advanced Television Development

In seeking information on the various proposals to improve or replace the NTSC standard to accommodate a system of terrestrial ATV transmission, the Commission has observed that, at this juncture, it wishes to consider "any system(s) that improves television audio and video quality or enhances in any way the current NTSC system as an 'advanced television system,'" and noted its view that, for purposes of this Inquiry, a "very broad and generic definition of ATV is appropriate so as to include all systems now under development or whose development [is] foreseen." (Notice at ¶19.)

In this connection, the Commission suggests that there are a number of promising techniques now under development which would improve the quality of the NTSC-delivered picture without increasing bandwidth, and which attempt to correct some of the defects of the NTSC standard cited in the Notice. The Commission identifies systems employing such techniques as "improved NTSC systems," as distinct from the range of other systems under development which are referred to in the Notice as "other enhanced TV systems." (Notice at ¶¶21-38.)

In Appendix B, CBS discusses in some technical detail, in light of the criteria discussed above, the specific systems to which the

Notice refers, as well as the more recent announcement by GE/NBC on its approach to advanced television. CBS suggests that, instead of the two broad categories of systems recognized in the Notice, more specific categorization would be helpful to the orderly consideration of the wide variety of ATV proposals. To that end, Appendix B arranges the proposed systems into groups and subgroups based on the range of relationships between such systems and the NTSC standard. Such a grouping facilitates comparisons between functionally similar systems and highlights the tradeoffs between levels of compatibility with NTSC and attainable technical quality. Thus, Appendix B categorizes those systems in the following way.

Single Channel, NTSC-Viewable

This category includes proposed ATV systems that would use the current terrestrial broadcast frequency allocation plan, and could be viewed on current NTSC receivers without the need for a converter:

1. Improved NTSC- No change in the transmission standard;
2. Enhanced systems- Compatible at some level* with NTSC transmission systems;
3. Temporally subsampled systems- Compatible at some level with NTSC transmission systems.

Single Channel Plus, NTSC-Viewable

This category includes those proposed ATV systems that would use the current terrestrial broadcast frequency allocation plan unchanged, but would require the assignment of

* See discussion on the appropriate definition of "compatibility" at pp. 41ff. of these comments.

unused frequencies within the current allocation for transmitting additional HDTV information.

Separate HDTV Service

This category includes proposed ATV systems that propose to retain the current allocation plan for continuing the current NTSC terrestrial broadcasting system, and to utilize a new frequency allocation for HDTV terrestrial broadcasting.

The technical discussion in Appendix B is, of course, preliminary and is based primarily on descriptions of the proposed systems that have been published to date. Authoritative conclusions as to whether particular systems can perform as claimed, and as to the extent to which they meet the criteria for terrestrial HDTV broadcasting service implementation, can be reached only after thorough critical evaluation. As discussed infra, that evaluation should include rigorous objective and subjective testing of proposed terrestrial HDTV transmission systems in realistic operational environments.

C. Quality-For-Bandwidth Tradeoffs

The Commission poses several questions in the Notice that it believes will bear on the "quality-for-bandwidth tradeoffs that distinguish the numerous advanced TV systems." (Notice at ¶40.) As discussed above, CBS believes that one preeminent criterion

for the consideration of ATV systems is the need for technical quality that will be competitive with that expected to be achieved by nonbroadcast media without spectrum constraints. Because the time for developing a terrestrial broadcast HDTV system will be limited, the focus of technical effort should be the development of a workable HDTV broadcast transmission system that meets all the proposed criteria and whose performance can be verified under realistic test conditions. The MUSE system is presently the only HDTV transmission system available for testing, but proponents of other systems ought to be able to bring them to a comparable state of development in a timely fashion, and should be encouraged to do so.

With respect to the Notice's query about the prospects for "an all-digital ATV system," CBS believes it is unlikely that there will be breakthroughs in technology to permit the rf and modulation portions of an HDTV system to be digital in the near future. However, all of the proposed systems make extensive use of digital techniques in production; in baseband processing in converting from the production standard to the proposed transmission standard; and for decoding in the receiver.

The Notice inquires into the relative costs of various transmission systems to program producers, broadcasters and consumers. CBS believes that it is premature to estimate such costs with any

specificity. However, HDTV production in general is likely to involve significant cost advantages over film production.* With respect to broadcasters, it is clear that any significant upgrade in transmission facilities is expensive, but is a periodic cost of doing business that licensees have always endured.** Any disparate cost to broadcasters of implementing one or another of various transmission systems is unlikely to be a major factor affecting the ultimate choice.

CBS has no estimates of its own concerning the costs to consumers of new HDTV television receiving sets. CBS notes, however, that when the Commission adopted its color standards in 1953, estimates before it suggested that color sets would be initially priced, in terms of 1953 dollars, "in the luxury range of \$800 and \$1000."*** Today, of course, color television sets far superior in quality than those first color sets can be purchased for \$300 (about \$50 in 1953 dollars). It is not unreasonable to assume that HDTV receiving sets initially will also be priced "in the luxury range," with mass production and sales later working to lower drastically the retail price of those receivers.

Finally, the Commission asks several questions about the "augmentation channel" approach to implementing a broadcast ATV

* Broadcasting, November 9, 1987, at 46.

** Cf., Color Television Order, supra, at 665

*** Id., at 670.

service. In CBS's view, this approach can be most usefully discussed in the context of the range of spectrum allocation issues raised in this proceeding. In the next section of these Comments, CBS offers its views on these allocation issues.

III. SPECTRUM ALLOCATION ISSUES

A. The Commission Cannot Make Appropriate Spectrum Allocations To Accommodate Terrestrial HDTV Broadcasting Until An Expedited Propagation And Systems Testing Program Is Pursued And Necessary Information Is Obtained.

The Commission states that it "intend[s] to resolve the spectrum-related issues in a rule making proceeding expeditiously" because it is "highly desirable to resolve these matters as quickly as possible... ." (Notice at ¶ 41.) CBS agrees that prompt consideration of all issues necessary to the implementation of broadcast HDTV service is absolutely necessary. However, the implications of the Commission's statement are that the spectrum-related issues can somehow be separated from the issues involved in choosing the most appropriate transmission standard for HDTV, and can be resolved before a definitive inventory of available UHF channels is developed after reexamination of the UHF taboos in the HDTV environment.

CBS urges that all of these issues are inextricably intertwined. As the Commission states elsewhere in the Notice, its "[s]pectrum decisions could have enormous implications for the structure of future regulatory decisions involving advanced television systems." (Notice at ¶47.) Under these circumstances, propagation,

laboratory and field testing of candidate HDTV transmission systems must lay the necessary groundwork for allocations decisions, since only after such testing will the Commission know the answers to critical questions. Such questions include whether HDTV can feasibly be broadcast using an NTSC channel with an augmentation channel, how wide such a channel need be, whether such an augmentation channel must be contiguous to the NTSC channel, whether microwave spectrum is technically suitable for terrestrial HDTV broadcasting, and whether true broadcast HDTV can best be initially provided through simulcasting NTSC and HDTV signals on separate channels.

While engineering experts can offer tentative opinions based on the paper specifications of some of the proposed systems and educated estimates on spectrum availability, it would be unwise to make allocation decisions with far-reaching consequences before the claims of system proponents have been thoroughly tested and an inventory is taken of usable spectrum.

A testing program which has already been instituted by the ATSC* is now exploring the feasibility of a UHF augmentation channel used in connection with a main VHF channel. In early 1988, the propagation characteristics of wideband 12 Ghz channels will be evaluated.

Empirical data from such tests must be obtained before,

* CBS understands that this testing program will be described in comments to be filed by ATSC in this proceeding.

for example, "the technical or economic advantages of [the UHF/VHF] spectrum option" can be determined. (Notice at ¶50.)

Similarly, it cannot yet be known whether "[i]t is worthwhile to pursue ATV at both UHF and microwave." (Notice at ¶53.) Rather, all that can be said at this point is that several frequency bands have potential and should be considered to be candidates for HDTV broadcast implementation pending information to be gained from propagation tests as well as laboratory and field tests of candidate transmission systems.

In conjunction with this objective system evaluation, a separate subjective testing program should be established, using representative panels of viewers, to determine the relative merits of each proposed transmission system under realistic viewing conditions. Such a testing program would assess:

- the perceived picture and sound quality of each proposed HDTV system when viewed on a moderately large screen (e.g., one meter in height), with high quality stereo speakers;
- the NTSC picture of NTSC-viewable systems, using an NTSC receiver and a standard NTSC picture as the standard for comparison.

Work should commence soon toward an agreement on subjective test methodology, including the environment, procedures and rating scale

to be used, so that such a methodology could be in place when candidate systems are available. At the same time, work should begin on developing appropriate test material and arranging for appropriate test sites.

CBS emphasizes that this initial focus on information-gathering is not inconsistent with expedited regulatory action. Rather, the complicated issues related to broadcast HDTV will be resolved most promptly if the Commission follows a methodical plan of action under which the energy and resources of the government and the affected industries are first applied intensely to system evaluation and the taking of an inventory of available spectrum. With information gained from these activities, appropriate and timely allocations decisions can then be made.

B. The Commission Should Acknowledge Some Guiding Principles For Future Allocations Decisions.

The Notice seeks comment on various issues related to the eventual use of UHF/VHF and microwave spectrum for ATV. As discussed above, detailed answers to many of the technical questions posed by the Notice cannot be provided at this point. However, it is useful to begin now to consider the implications of the various allocations decisions that the Commission might ultimately make, and CBS offers its preliminary views on some of these matters.

1. Any Terrestrial HDTV Broadcast System Ultimately Implemented In The United States Should Allow All Existing VHF And UHF Licensees To Cover Their Present Service Areas With An HDTV Signal, And The Present Allocations Scheme Should Not Be Disrupted In The Interim.

There is neither a compelling policy reason nor any known technical reason why the existing structure of local broadcasting in the United States need be significantly disrupted by the introduction of HDTV. Rather, any future HDTV system for the United States should be built around the existing VHF/UHF license structure. That is, the goal of the Commission in making the necessary allocations decisions should be to allow the present potential audience of every broadcast station to make the transition to viewing the programming of that station in an HDTV format. Further, CBS strongly believes that, during any transition to terrestrial HDTV broadcasting, the present VHF/UHF allocations scheme for the broadcast of NTSC programming to the current television audience should not be disturbed.

The application of this principle will affect the ultimate choice of an HDTV transmission standard. That is, a candidate system that employs a UHF augmentation channel to create an HDTV signal must be tested to determine whether it can combine that augmentation channel with a VHF NTSC channel and propagate an adequate HDTV signal throughout the existing service area of the station.*

* The MUSE system was demonstrated in Washington, D.C. in January 1987 using two contiguous UHF channels with an 8.1 MHz baseband signal transmitted in VSB-AM format. See, Broadcasting High Definition Television: (footnote continued next page)

If that proves to be infeasible, such an approach should not be pursued unless, for example, the Commission is willing and able to allot to all VHF licensees additional UHF spectrum that is sufficient in itself for HDTV transmissions while the VHF channel is still used by the licensee to reach its present audience during the transition period. Further, a VHF licensee should be able to transmit HDTV signals over those additional UHF channels at a power sufficient to reach the present audience of its VHF station.

Of course, microwave spectrum (which is almost certainly too dissimilar to UHF spectrum to be useful for VHF/UHF augmentation channels) should also be thoroughly tested and considered for self-standing HDTV transmissions as an alternative to "add-on" UHF channels if they do not prove to be practicable for both VHF and UHF licensees.

2. The Ultimate Nature Of The Terrestrial HDTV Broadcasting Service Depends On The Characteristics Of The Transmission System Selected.

The Notice offers three hypotheses about the relationship of an ATV service to the existing television service. It suggests that ATV could be instituted:

- "as a new service separate and distinct from the existing television broadcast service;"

(footnote continued from previous page) Interim Report to the Federal Communications Commission, submitted by the NAB on September 28, 1987. While that demonstration convincingly suggested the feasibility of HDTV terrestrial broadcasting, the MUSE system is not designed to operate on non-contiguous UHF channels or on a combination of VHF/UHF channels.

- "as a service that augments wherever feasible existing NTSC service with no provision for full replacement of the NTSC service;"
- "as a service integrated fully with the existing television broadcast service which over time would replace entirely the NTSC service." (Notice at ¶43.)

Articulating such alternative hypotheses may serve a useful purpose in helping to make the complex issues involved in a transition to HDTV terrestrial broadcasting coherent at this early stage of the Commission's inquiry. However, CBS believes that the Commission should be careful not to commit itself yet to any one rigid set of assumptions. Rather, the Commission should at this point simply look toward a true HDTV standard that will afford to every existing television licensee the opportunity to deliver HDTV to those in its service area that are equipped to receive it, and to continue to deliver NTSC programming to those not so equipped.

This might be accomplished in either of two general ways. If an HDTV augmentation channel is proved feasible and able to provide sufficient technical quality to viewers of the combined HDTV signal and to viewers of a part of that signal that is viewable on normal receivers, then the last of the Commission's hypotheses would hold.* That is, the HDTV service would be "integrated" with

* It would also apply in the event that a 6 MHz channel were demonstrated to be able to accommodate a true HDTV signal that is also viewable on existing receivers (see Appendix B, at pp. 1-8).

the present television service and could ultimately replace it. However, if testing reveals that simulcasting by television licensees of programming using NTSC and an HDTV standard in microwave spectrum is the best alternative, terrestrial HDTV broadcasting may well begin as the "separate and distinct" service described in the Commission' first hypothesis noted above.*

3. The Planning Factors For Terrestrial HDTV Broadcasting Implementation Will Depend Upon The Method Used For Transmission.

The Commission should be prepared to employ flexible technical planning considerations for terrestrial HDTV broadcasting. To the extent that the VHF/UHF frequency bands are employed, it may be feasible to use many of the technical planning factors now used for the NTSC service, such as a single transmitter for an entire service area and a 50-60 mile service contour. However, several other parameters -- such as channel bandwidth, radiated power limits and receiver front-end characteristics -- will differ. The Commission will have to utilize both propagation data and transmission system characteristics to arrive at an optimized set of planning factors.

Of course, the ideal solution to the problem of allocation of spectrum for terrestrial HDTV broadcasting would be to retain the

* The remaining hypothesis -- an HDTV service that augments NTSC service only "wherever feasible" -- is inconsistent with the goal that all existing licensees be included in an HDTV implementation plan, and anything less should be not now be considered.

same 6 MHz channel bandwidth used for NTSC transmissions in the UHF and VHF bands.* As the Commission notes, however, there is danger in the preoccupation with "fitting" an improved television signal into the present 6 MHz VHF/UHF channel bandwidth, since that "may not yield quality comparable to other present or future advanced television systems that use greater bandwidths." (Notice at ¶ 47.) Indeed, CBS is not aware of any meaningfully developed hardware program that can deliver an HDTV signal in a 6 MHz bandwidth.** Over the last few years, engineers in Japan and the United States have been able to reduce an HDTV signal baseband to 8-16 MHz from the nominal 30 MHz. One of the best proven signal compression techniques is the MUSE system that employs 8.1 MHz bandwidth, utilizing up to 10 Megabytes memory in the receiver, while maintaining a threshold level of performance of HDTV signal quality.***

In general, the purported spectrum requirements of ATV systems, when transmitting at UHF/VHF, range from 6 MHz to significantly more.

* Unless a 6 MHz ATV transmission could be received as a normal transmission on existing television sets, the Commission would still be faced with allocation of new spectrum for simulcasting or the prospect of substantial costs to the consumer to modify or replace those sets.

** The proposed NBC/GE system, which is supposed to deliver an ATV signal in the current 6 MHz allocation, is still in the computer simulation stage. While the NBC attempt is laudable, CBS believes that it is too soon to arrive at any meaningful conclusion about this concept.

*** "HDTV Broadcasting And Transmission System-MUSE-", Ninomiya, Ohtsuka, Izumi, Gohshi and Iwadate, HDTV Colloquium '87, Vol. 1, pp. 4.1.1-4.1.31 (October 1987)

During this preliminary planning stage, until the testing of transmission systems provides some answers, a conservative estimate is that an HDTV signal would require two 6 MHz channels for transmission in the UHF/VHF bands (utilizing VSB-AM modulation).

If microwave frequencies are employed instead of VHF/UHF for the provision of terrestrial HDTV broadcasting, the planning considerations will have to be radically different.* Propagation characteristics at microwave frequencies limit the size of the coverage area of a single transmitter, so that service to an existing coverage area of a VHF/UHF station would likely require multiple transmitters. Further, microwave frequency use requires planning factors that vary greatly from those for VHF/UHF frequencies with regard to modulation format,** transmitter design and receiver front-end characteristics.

* Another possibility is the use of VHF/UHF spectrum for "add-on" channels except in dense urban environments where multipath echoes may make the combination of separate channels most difficult. In such situations a relatively low power microwave transmitter might be used in combination with small consumer antennas and combat the effects of multipath echoes or even utilize multipath echoes at locations screened from line-of-sight to the transmitter.

** In a microwave transmission in the 12 GHz band, FM modulation is likely to be preferable, since it can provide sufficient signal quality to overcome propagation losses. 12 GHz HDTV transmissions may require at least 24 MHz of channel bandwidth if testing confirms the need to employ FM modulation to enhance received signal quality. The MUSE system was designed to be transmitted via RARC-83 DBS bandwidth allocations of 24 MHz, utilizing analog FM modulation. If 12 GHz spectrum is ultimately used for terrestrial HDTV broadcasting, the Commission may want to employ planning factors (e.g., modulation, (Footnote continued next page)

C. While Propagation And System Testing Proceeds, The Commission Should Develop Information On The Continuing Need For UHF Taboos In The HDTV Environment.

While the active testing program is proceeding, the Commission should update its information on the continued necessity of the UHF taboos and otherwise determine as exactly as possible the amount of usable spectrum at UHF frequencies.* The Commission has suggested that new spectrum could become available in the UHF band as a result of elimination of some or all of the spacing "taboos" that determined the structure of the original UHF allocation scheme. However, in the HDTV context, the Commission does not have information on which to base judgments concerning taboo modification or elimination where VHF/UHF transmission of various HDTV formats is involved. Ultimate decisions on the amount of UHF spectrum that might become available is dependent both on improvements in NTSC receiver design that have taken place since the taboos were instituted and on the interference potential of the various modulation formats of the candidate HDTV systems that propose to operate at UHF.

(Footnote continued from previous page) channelization, polarization) that take into account the possibility, however remote, that high-power direct broadcast satellite service would eventually be offered at those frequencies.

* Because the overall inventory of VHF channels is relatively small, it seems evident that very few such channels could be made available for use as augmentation or self-standing channels for terrestrial HDTV broadcasting without reassignment of existing VHF licensees to UHF. CBS urges that any reassignment of existing licensees would result in unacceptable inequities to licensed broadcasters and would grossly disserve the public that has long relied on those VHF stations for information and entertainment.

As for improvements in receiver design, the Notice describes the history of Commission activity looking toward reevaluation of the UHF taboos and offers some tentative conclusions about their continuing necessity in the context of the NTSC-based television service. (Notice at ¶¶68ff.) The implication of the information that has already been developed is that a significant amount of now unused UHF spectrum could be made available for use as free-standing or add-on channels for terrestrial HDTV broadcasting.

However, as the Notice recognizes, "[a]ny general discussion of the impact of the existing or modified taboos on the implementation of future advanced television systems and the impact of improved advanced television receivers on the need for the UHF taboos would be premature at this time." (Notice at ¶ 78.) CBS agrees that this is so, because the modulation format of each proposed HDTV system may be expected to have a different interference potential that will lead to different conclusions about the need for taboos when transmitted using UHF spectrum.

That is, the fact that a transmission system purports to need only a single channel (e.g., the NBC system) does not lead to the conclusion that UHF taboos could be eliminated to the same extent that they might when the NTSC transmission system is employed. Further, the modulation format of systems requiring a UHF "add-on" channel or a new wider channel allocation might necessitate

new taboos to prevent an unacceptable adverse impact on the use of existing receivers.

Under these circumstances, the Commission should take a methodical approach to the problem of UHF taboos and continue to collect and validate information bearing on the necessity of retaining UHF taboos in the NTSC environment. At the same time, the modulation format of each HDTV transmission system should be identified and analyzed in terms of its interference potential when transmitted at UHF frequencies, and this information collated with what is already known about the taboos in the NTSC environment. In this way, the Commission can ultimately assess the feasibility of a UHF allocation plan that takes into account both the existing NTSC transmitter/receiver environment and the HDTV environment.

D. Until The Necessary Questions Have Been Answered, The Commission Must Preserve All Of Its Options For Allocating The Necessary Spectrum To Implement Terrestrial HDTV Broadcasting.

The February 1987 NAB and MST petitions that preceded this Inquiry described at length the need for the Commission to forbear from any action that would deplete the amount of UHF spectrum available for HDTV broadcasting, at least until the spectrum needs of that service are known. CBS supported those petitions, and applauds the Commission for acting to defer further land mobile sharing of the

UHF TV band at least until the Advisory Committee files an interim report.*

The Commission has for now declined, however, to reserve a portion of the 12.2-12.7 GHz band for the same period. CBS continues to believe, as it noted in its comments in support of the MST/NAB petition, that it is just as important to preserve the availability of the microwave spectrum that testing may reveal to be appropriate for HDTV transmission.

More specifically, CBS continues to believe that the 12 GHz band holds promise for terrestrial HDTV broadcasting, and that its propagation disadvantages may prove not to be insurmountable. While that technical conclusion has yet to be proven, preliminary tests by CBS are encouraging.** A notable advantage of pursuing the practicability of 12 GHz among the various microwave options is the fact that this band was allocated at the 1979 World Administrative

* Order, GEN. Docket No. 85-172, supra.

** CBS/Westinghouse 12 GHz propagation tests were conducted in San Francisco in 1982, using the facilities of KPIX-TV. Even with a low power (10-watt) transmitter using frequency modulation, acceptable reception was possible at 70% of the test sites, both for the random locations throughout the metropolitan San Francisco area, and for the statistical grid within that portion of the city illuminated by the transmitting antenna. CBS Submission of Test Results of its Experimental 12 GHz Terrestrial Broadcast Operation, GEN. Docket Nos. 80-398, 80-603, 80-739, August 16, 1982. Besides these propagation tests, the NAB/MST Washington MUSE demonstration described above included transmissions at 12 GHz that provided satisfactory reception.

Radio Conference to terrestrial broadcasting and the Broadcasting Satellite Service on a shared basis.* Of course, the Commission in 1982 voluntarily vacated that shared allocation in favor of a domestic direct broadcast satellite service ("DBS") because of the demand it perceived at that time for institution of high-powered direct-to-home video transmission services.** Today, however, the situation has changed, and the prospects are diminishing for the institution of DBS service using any significant portion of 12 Ghz spectrum, which is evidenced by the surrendering of construction permits by some parties and the assertion by current DBS licensees of a newfound "risk...that DBS might develop more slowly or to a lesser degree than expected."***

Thus, the likelihood of a DBS service at 12 Ghz continues to diminish as other competitive video delivery systems expand and potential DBS service providers migrate to the Fixed Satellite Service ("FSS"). The FSS provides for more flexible transponder channelization and the Ku-Band EIRP limit of 53 dBw is considered

* Final Acts of the World Administrative Radio Conference, International Telecommunications Union, Geneva, Switzerland, July 1979.

** Report and Order, GEN. Docket No. 80-603, 90 FCC 2d 676 (1982).

*** Memorandum Opinion and Order, In Re Petition of United States Satellite Broadcasting Company, Inc., File No. DBS-DR-1, 1 FCC Record 977 (1986). Several DBS permittees are still assigned frequencies in the 12 GHz band; in fact, the full 500 Mhz of spectrum at two orbital slots, at least, remains fully assigned at this time.

adequate to deliver a satisfactory signal to reasonably priced home earth stations. In fact, significant improvements in receiver sensitivity now permit reception of adequate signal quality with antennas less than one meter in diameter.

Whether and how to vacate sufficient Ku-band DBS spectrum and return it to terrestrial broadcasting is a decision entirely in the hands of the Commission, and CBS disagrees with the Commission's view that "it would be highly disruptive to this new service to reduce the available spectrum."* At the very least, the Commission should not foreclose the possibility of reserving a portion of that 12 GHz spectrum (i.e., 12.2-12.45 GHz) for terrestrial HDTV broadcasting promptly if the interim report of the Advisory Committee suggests that microwave delivery of terrestrial broadcast HDTV should remain under consideration.**

Another promising possibility for evaluation is the 4.5-4.8 GHz band, which is one of the "expansion bands" to be considered

* Order, GEN. Docket No. 85-172, supra, at 2.

** The U.S. was allotted eight orbital slots of 500 MHz each at the RARC-83 conference. There are 192 channels capable of providing adequate nationwide DBS signals (the remaining channels can provide service to either the eastern or western portions of the U.S.). The Commission can still preserve the potential for DBS service by assigning only 250 of the 500 MHz of DBS spectrum to terrestrial broadcasting. In order to achieve this more efficient allocation scheme, the Commission should undertake at the appropriate time to modify the channel allocations of DBS permittees where demonstrable schedules for spacecraft construction would not be jeopardized.

for satellite transmission use primarily by developing countries at SPACE WARC-88 in Geneva. There are apparently no conflicting implementation plans in the United States, and that spectrum should be kept available as a possibility for terrestrial HDTV broadcasting, although special planning would have to be considered for areas near the borders of Canada or Mexico if these nations seek to implement satellite transmission in this band.

Finally, the Notice suggests the possibility of making available spectrum at 2.5 GHz and 23 GHz for terrestrial HDTV broadcasting. (Notice at ¶52.) While CBS's preliminary view is that the availability of sufficient spectrum at 2.5 GHz is doubtful and that terrestrial HDTV broadcasting at 23 GHz is unlikely to be proven feasible in the near term due to rain attenuation problems, CBS believes that these options should continue to be considered and evaluated. Another technical possibility, 13 GHz, is in great and increasing need for electronic newsgathering services and should not be reallocated for other services, including HDTV.

In sum, the 4.5-4.8 GHz spectrum and the 12 GHz spectrum seem now to hold the most promise in meeting terrestrial HDTV broadcasting transmission requirements in the microwave spectrum. Since both bands suffer attenuations due to foliage and rain (especially 12 GHz) and require line-of-sight between the transmitter (or a suitable reflecting object) and the receiving antenna, the areas servable by individual transmitters will be smaller than UHF/VHF

service areas, but multiple transmitters are likely to be feasible and not inordinately costly.

IV. ADVANCED TELEVISION COMPATIBILITY ISSUES

A. The Commission Should Take A Flexible And Comprehensive Approach To The Issue Of Compatibility.

The term "compatibility" should be used with care in comparing potential terrestrial HDTV broadcast systems to the current NTSC system, since it is potentially confusing and misleading. In part this is because the word is often used indiscriminately to refer to several different relationships. Indeed, the Notice applies the term in three different ways to HDTV transmission systems:

- "An ATV system will be considered to be compatible with the existing television channel allotment plan if it operates consistent with the present 6 MHz channelization scheme." (Notice at ¶81.)
- "[A]n advanced TV system will be considered to be receiver compatible if the advanced signal can be decoded and viewed on a conventional NTSC receiver." (Notice at ¶81.)
- "[Compatibility] may also be used to describe the ability of a receiver designed to display one ATV format to also display a signal using another advanced television format." (Notice at ¶80.)

CBS believes that the Commission can avoid this confusion by focusing on the most immediate issue, that of the public interest in avoiding the accelerated obsolescence of existing NTSC television sets. Such obsolescence can be avoided either by an appropriate

degree of "receiver compatibility"* or by the functionally equivalent means of simulcasting programming in NTSC and HDTV formats during the transition period.

Perhaps the most important problem with the conventional notion of "compatibility" is that it is typically applied simplistically, so that a system is thought of as either "compatible" with another system -- and thus acceptable -- or "incompatible" -- and thus unacceptable. CBS believes that the Commission should examine receiver-compatibility issues from a much more comprehensive perspective that takes into account gradations of compatibility.

In that regard, a recent CBS contribution to the CCIR** describes six levels of compatibility for analytical purposes, as follows:

"The highest level (LEVEL 5) is represented by a system whereby HDTV transmissions are received on a receiver which displays the picture in high definition. The concept represents the highest attainable level of compatibility, and it is embodied by receivers designed for the HDTV service."

"The next lower level of compatibility (LEVEL 4) is represented by a system whereby a receiver accepts HDTV transmissions and displays the picture with the same quality

* Channelization compatibility does not necessarily correlate with receiver compatibility since an HDTV signal that is compressed into 6 MHz might still not be receivable at all on an NTSC receiver. The compatibility of one HDTV transmission system with another, while an important determinant of the ultimate course of HDTV video distribution, is subsidiary to the receiver compatibility issue.

** CCIR Document 11/106, Revision 1, August 6, 1987.